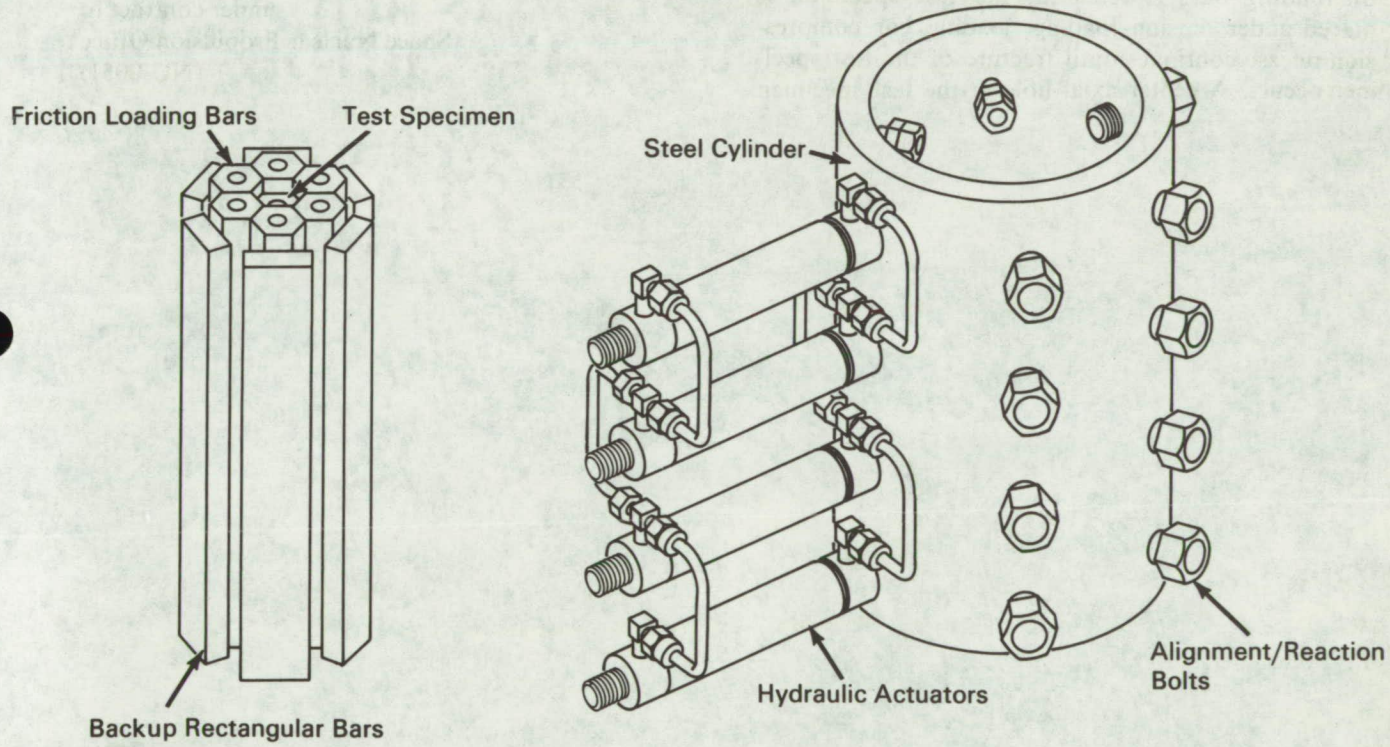
July 1966

Brief 66-10345

NASA TECH BRIEF

Friction Loading Device Enables Accurate Testing of Brittle Materials



The problem:

Tensile testing of extremely brittle materials such as graphite, beryllium, and ceramics requires that true axial alignment be maintained in the specimen to avoid the introduction of bending stresses. In practice, it has been impossible to determine the tensile strength of these materials accurately, utilizing conventional methods.

The solution:

Friction loading along the surfaces of the specimen applied by a unique bundling process insures axial symmetry of the test specimen.

How it's done:

The test fixture consists of a thick wall steel cylinder of a diameter and length consistent with the size of the specimens to be tested. Six equally spaced rows of radially tapped holes are cut into the walls of the cylinder. These holes accept either hydraulic actuators or alignment/reaction bolts. This arrangement permits six face loadings of specimens having a hexagon cross section. The test specimen is assembled by surrounding it with six friction loading bars which are slightly longer in length than the test specimen. Backup rectangular bars serve to uniformly distribute the lateral

(continued overleaf)

loading. The mating faces of loading bars are machined to provide a small clearance so that the full lateral load is carried by the test specimen.

The bundled specimen is centered in the lateral loading cylinder which is then positioned on the Wiedeman Universal Test Machine (not shown), with a compression loading block supporting the outer friction loading bars. Lateral loading is provided by the hydraulic actuators hooked in series by tubing to a pressure control unit. With a very light lateral pressure applied, the outer friction loading bars are compressed by a predetermined amount through a top compression block by the Wiedeman Machine. The hydraulic actuators are then pressurized to a preset pressure and the compression loading on the loading bars is released at a uniform rate. As the loading on loading bars is released, the test specimen is placed under tension loading; loading bar compression release continues until fracture of the test specimen occurs. A center axial hole in the test specimen facilitates instrumentation for monitoring the strain buildup in the specimen.

Note:

Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
AEC-NASA Space Nuclear Propulsion Office
U.S. Atomic Energy Commission
Washington, D.C. 20545
Reference: B66-10345

Patent status:

No patent action is contemplated by NASA.

Source: T. F. Hengstenberg
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under contract to
Space Nuclear Propulsion Office
(NU-0051)